The Impact of Critical Factors on the Adoption of Green Building Technologies in Sri Lanka

Kirubashalini Thangaraj, Dissanayake. D.M.T.D*

Department Business Management, Faculty of Business Studies & Finance, Wayamba University of Sri Lanka, Kuliyapitiya ,60200, Sri Lanka

DOI: https://dx.doi.org/10.47772/IJRISS.2025.903SEDU0046

Received: 21 January 2025; Accepted: 25 January 2025; Published: 24 February 2025

ABSTRACT

At present, the building and construction industries have become crucial due to the growing challenges of climate change, natural disasters, and socio-economic uncertainties worldwide. Green building technologies are one of the most effective solutions, promoting sustainable development in the environment, economy, and society within the construction industry. To effectively adopt green building technologies, it is crucial to identify and explore the key critical factors that influence successful implementation. This paper aims to explore the adoption of Green Building Technologies, focusing on the perspectives of specialists in the construction industry. While global implementation has shown success in the adoption of green building technologies within the construction industry, their application in developing countries, particularly in Sri Lanka, remains limited. In this study, a quantitative review was conducted, focusing on key factors derived from the Theory of Planned Behaviour. The current research is completely focused on the stakeholders' adoption behavior and solely uses descriptive statistical analysis to find out the critical factors influencing the application of Green Building Technologies. Findings revealed the strategies for overcoming barriers and enhancing the uptake of sustainable building practices in Sri Lanka, ultimately contributing to the environmental and economic development goals of the country. The article provides professionals and other industry stakeholders useful insights about the foreseeable future of the country's construction sector.

Key Words: Green Building Technologies, Construction Industry, Theory of Planned Behaviour, Developing Country, Sustainability

INTRODUCTION

In today's world, the Earth's ecosystems are at a critical stage. Human activities are causing irreversible losses of important ecosystem functions. Buildings and construction account for the largest share of global resource consumption and pollution emissions. In OECD countries, the built environment accounts for approximately 25-40% of total energy use, 30% of raw material consumption, 30-40% of global greenhouse gas emissions, and 30-40% of solid waste production. (Vatalisa et al., 2013). According to Yudelson 2007 globally, buildings are responsible for more than 40% of all GHG emissions. Additionally, the construction industry is widely recognized as a resource-intensive sector (Shi et al., 2017), consuming 40% of the world's raw materials such as sand, gravel, and stone, 25% of global timber resources, and 12-16% of the available freshwater supply (Berardi, 2013a). These facts show that the sustainable development of buildings would contribute significantly to the environmental pollution into the atmosphere and have negative effects on the environment, economy, and society. Construction activities and operations generate large quantities of dust, solid waste, noise, wastewater, and smoke (Shen et al., 2017). Nevertheless, it's undeniable that the construction industry plays a vital role in socio-economic development. According to the United Nations Environment Programme (UNEP) (2009), the construction industry contributes between 10-40% of countries' gross domestic product (GDP) and represents, on a global average, 10% of country-level employment. Likewise, the construction industry makes great contribution to the national economy via playing a core role in urbanization; it provides living and working spaces for humans (Zhang, 2015). The Sri Lankan construction industry, which is one of the biggest GDP contributors and employment generators in the country, expected to register an average annual growth of 5.9% from 2024 to 2026, supported by investment in transport, renewable energy, housing, industrial zone, and tourism projects, finance ministry sources revealed (Sri Lanka – Commercial Guide, 2024).

In recent years, improving the sustainability of buildings has become a key priority for the construction industry. As a strategy to improve the sustainable development of the construction industry, green buildings have gained widespread acceptance by all countries around the world (Shen, 2017). Green building is an effective solution for promoting sustainability and sustainable development within the sector (Sev, A. 2009; Son et al., 2011). Thus, the development of green buildings would result in substantial minimization of negative environmental effects and efficient utilization of resources (Hwang, 2018). Over the past two decades, there has been a growing emphasis on green building development, resulting in a global shift towards more sustainable construction practices (Construction M.H, 2013). Increasingly, the need for green technology has come to the forefront in both developed and developing countries (Bhattarai et al. 2013). Because of the higher environmental performance, green building construction has recently become a new trend in Sri Lanka as well (Waidyasekara and Fernanado, 2013).

Green building technology (GBT) is defined "The practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's lifecycle" (USNP, 2016). GBTS includes solar systems, green roofs and walls, heat pumps and the application of corresponding technologies throughout the construction project delivery process (Hwang, B.G,2017). In terms of green buildings, people remark that "During the life cycle of the entire construction project, the construction and use of buildings are environmentally responsible and improve the effective utilization of energy efficiency" (Shen et al., 2017). Because of the negative impact of conventional buildings on both the environment and the climate, green buildings are perceived as effective substitutes for traditional buildings. It plays an important role in environmental protection and resource conservation (Hwang et al., 2017).

The World Economic Situation and Prospects (2014) classifies developing countries as those with gross national income (GNI) per capita of US$12,615 or less. As a developing, Sri Lanka GNI per capita for 2023 was US$3,540 (World Bank, 2024). While it is well-known that developing countries face numerous challenges, such as deep poverty, rapid urbanization, weak governance, environmental degradation, and social inequity (Du Plessis, 2007), According to the United Nations Human Development report that 85% of the world's population is still living in developing countries (Klugman, 2011). This is an indication that the impact of developing countries on the world's economy and environment is tremendous, thereby making sustainable development a necessity rather than an option for developing countries (Du Plessis, 2007). Additionally, it is estimated that the global population will increase from 3.6 billion in 2011 to 6.3 billion by 2050, with 94% of this growth occurring in developing countries (United Nations, 2012). While governments in these nations have already made significant investments in building projects (Gan et al., 2015; Ghoddousi et al., 2015), the demand for new construction is expected to rise further due to the growing population. As a result, adopting sustainable construction practices, including green building technologies (GBT), is essential to minimize environmental impacts and support the sustainable development of developing countries. The promotion and integration of GBTs in the construction industries of countries like Sri Lanka is crucial for achieving these goals.

Recently, climate-change, energy crisis and increasing environmental pollution have made the sustainable development issue receive great attention from the world (EPA, 2008). Adopting green innovations is essential to attain the sustainable development of the construction industry. A crucial condition for the transformation of traditional buildings to green buildings is the integration and innovation of various stakeholders in the application of GBTS. Although the concept of green building has been around for several decades, many people still have a limited understanding of it. Green building involves a collaborative effort across various sectors, forming a complete industrial chain from production to operation. As the distinctive parts of this industry chain, administration, real estate institutions, research and design institutions, construction organization, product supplier, consumers, financial institutions and media are all a driving force and influential factor in the development of green building. As highlighted by Zhang et al. (2018), GBTs adoption in buildings is a key step towards global sustainable development. However, GBTs adoption has been slower in developing countries than in developed countries (Mao et al., 2015; Nguyen et al., 2017). GBTs adoption and development is not free of barriers and difficulties. First, this could be associated with the fact that sustainability is generally not perceived as a priority in the delivery of construction projects within developing countries (Shen et al., 2010; Tabassi et al., 2016). Second, numerous contextual issues such as Cost, knowledge and interest are the main barriers. Motivation, practice, attitude, values and culture are bottom-up approaches, such as higher upfront costs of green buildings present a serious challenge (Geelani et al., 2012). The lengthy pay-back time is another barrier to sustainable building (Millicent et al., 2015). Additionally, there is a widespread misconception that GBs are expensive and challenging for middle and lower-class individuals to access (Azizi et al., 2015). A lack of knowledge and resistance to change are also significant barriers to GB projects (Djokoto et al., 2014). The shortage of skills further hampers green construction efforts, leading to potential delays in project completion (Millicent et al., 2015). Although Sri Lanka has several regulatory requirements to support local green growth, no specific law or policy focuses on GB construction (Ratnasiri, 2012). Despite these challenges, various forces drive and influence the adoption of GBTs among construction professionals and stakeholders across different countries and regions.

Research on the factors hindering the adoption of green building technologies (GBT) and potential solutions has been recommended as it could inform the development of effective policies and strategies to promote their use (Mulligan et al., 2014; Darko et al., 2017). However, much of the existing research consists of case studies with limited generalizability (Koebel et al., 2015) or descriptive analyses that emphasize the importance of GBTs without providing quantitative evidence based on the perspectives of industry professionals. As a result, a comprehensive quantitative survey is needed to address these gaps. Furthermore, since green building practices vary across countries and regions (World GBC, 2017), many of the previous studies have focused on specific countries or regions, identifying the relevant GBTs for sustainable housing development in particular areas or cities (e.g., Roufechaei et al., 2014; Ahmad et al., 2016).

The current research is completely focused on the stakeholders' adoption behavior and solely use descriptive statistical analysis; there is an absence of targeted in-depth research from the perspective of the construction industry's specialists in developing countries. However, research specifically focused on the critical factors influencing GBT adoption in developing countries remains limited. A recent review by Darko et al. (2017) highlighted the scarcity of studies analyzing these critical forces in such contexts. Only a few studies related to GBTs have been conducted in the Sri Lankan context. Thus, this paper attempts to fill the research gap of empirical by exploring the perspectives of the construction industry's specialists on adopting green building technology. Through in-depth analysis, it seeks to explore industry attitudes, challenges, and opportunities related to the implementation of sustainable practices, ultimately contributing to a greener future in construction. Therefore, the objective of this study is to identify the impact of key critical factors on GBTs adoption in the construction industry, with a focus on Sri Lanka as a developing country. The present research contributes to this scholarship through focusing on GBTs.

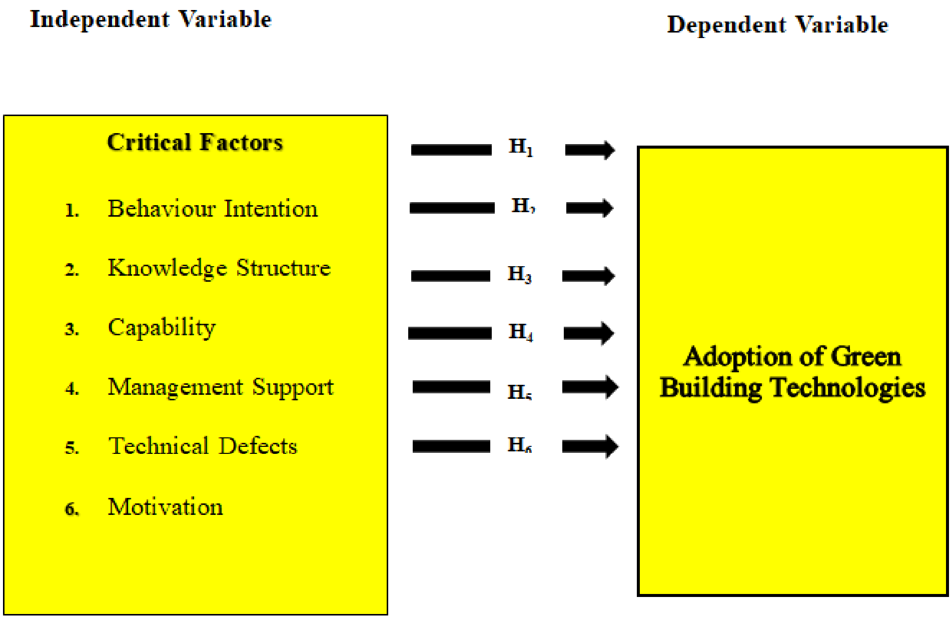
Research Questions

1. Is there any significant impact between Behavior Intention on GBT's Adoption?
2. Is there any significant impact between Knowledge Structure on GBT's Adoption?
3. Is there any significant impact between Capability on GBT's Adoption?
4. Is there any significant impact between Management Support on GBT's Adoption?
5. Is there any significant impact between Technical Defects on GBT's Adoption?
6. Is there any significant impact between Motivation on GBT's Adoption?

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume IX Issue IIIS January 2025 | Special Issue on Education

MATERIALS AND METHODS

Figure 1 Conceptual Framework



Source: Wei Wang et al., 2018

The Theory of Planned Behaviour is a foundational concept in social psychology, with behavioural intention serving as a primary determinant of actual behaviour. Ajzen and Fishbein, 1980 proposed that any variable influencing behaviour should also impact its intention through behavioural attitudes. In the context of green building technology systems (GBTS), the behavioural intentions of various stakeholders play a crucial role in determining their adoption behaviours, which subsequently affects organizational effectiveness. Therefore, the Theory of Planned Behaviour provides a valuable theoretical framework for examining the adoption behaviours associated with GBTS. Several key factors influence the adoption and successful implementation of GBTS. Based on these factors can be categorized into six main areas: Behaviour Intention, knowledge structure, capability related to GBTS, management support, motivation, and technical limitations of GBTS. According to the conceptual framework, the objective of this research is to identify and measure the impact of critical factors (Behaviour Intention, Knowledge Structure, Capability, Management Support, Technical Defects and Motivation) on the adoption of Green Building Technologies in Sri Lanka.

Data was obtained from the completed questionnaires issued to the managerial employees in construction companies in Sri Lanka. In this study the researcher used the Statistical Package for Social Sciences (SPSS) to conduct validity analysis, reliability analysis, correlation analysis and multiple regression analysis. In this study the researcher selected samples using convenient sampling method. The survey of Skills Gaps Analysis of the construction industry Sector in Sri Lanka, 2024 indicates that there are approximately 10,000 establishments within the sector, employing an estimated total workforce of 641,636 individuals. This study focused on managerial employees in the industry includes Senior Administrative Officers, Senior Architect, Chartered Quantity Surveyor, Charted Engineers, and Project Managers in the construction field. However, due to the heterogeneous composition of the workforce, the population for this research is considered unknown and samples were taken using Cochran’s Formula (1953) which consist of 384 respondents. According to the Sri Lanka Export Development Board, a sample of 20 construction companies from various regions of the country has been selected for this study. This selection is strategically justified to ensure a diverse representation of the construction sector, encompassing various company sizes, operational scales, and regional characteristics.

Hypotheses of the Study

The conceptual framework provides foundation for entire research project and demonstrates the sketch of the research. This refocus identifying a impact with key variables, below hypothesis were developed.

H_1: There is a significant impact between Behavior Intention on GBT's Adoption.

H_2: There is a significant impact between Knowledge Structure on GBT's Adoption.

H_3: There is a significant impact between Capability on GBT's Adoption.

H_4: There is a significant impact between Management Support on GBT's Adoption.

H_5: There is a significant impact between Technical Defects on GBT's Adoption.

H_6: There is a significant impact between Motivation on GBT's Adoption.

Operationalization

Operationalization is done from the previous literature with the objective of measuring all independent variable and dependent variable which are specified in the conceptual framework to provide a quantifiable result. Through operationalization, researcher can deliberately gather information on processes and phenomena that aren't directly noticeable.

Table 1.1

Variables	Items	Indicators	Measurement Scale	Source
Behavior Intention	BI1	We are willing to introduce GBTS into our work.	Five Point Likert Scale 5 – Strongly Agree 1 – Strongly Disagree	Wei Wang et al.,2018
	BI2	We are always very active in trying to adopt GBTS in our work.		
	BI3	We will advise project partners to apply green processes or equipment.		
Management support	MS1	Senior managers expect staff to use GBTS to complete work.	Five Point Likert Scale 5 – Strongly Agree 1 – Strongly Disagree	Wei Wang et al.,2018
	MS2	Employees will be rewarded for completing work by adopting GBTS.		
	MS3	Senior managers take the initiative to provide GBTS education and training to the employees.		
GBTS capability	CP1	Collaborators agree with our idea of adopting GBTS.	Five Point Likert Scale 5 – Strongly Agree 1 – Strongly Disagree	Wei Wang et al.,2018
	CP2	If necessary, the relevant units will make efforts to provide assistance for the introduction of our GBTS		
	CP3	Our design company and working partners often have regular communication activities on GBTS (E. g., green technology and products promotion sessions, seminars, etc.).		
Motivation	MO1	Industry Management requires to actively adopt GBTS.	Five Point Likert Scale 5 – Strongly Agree 1 – Strongly Disagree	Wei Wang et al.,2018
	MO2	GBTS can improve the quality of construction projects.		
	MO3	GBTS are helpful to sustainable development of construction industry.		

Knowledge Structure	KN1	When GBTS are introduced into design work, we have the knowledge and ability to do it.	Five Point Likert Scale 5 – Strongly Agree 1 – Strongly Disagree	Wei Wang et al.,2018
	KN2	Having enough knowledge of green materials or equipment will make it easier for me to adopt GBTS.		
	KN3	Comprehensive knowledge of other professions will help me to adopt GBTS.		
Technical Defects	TD1	GTBS or integrated process can take a offers a valuable opportunity for ensuring high-quality results and less time	Five Point Likert Scale 5 – Strongly Agree 1 – Strongly Disagree	Wei Wang et al.,2018
	TD2	The introduction of GBTS in process effectively address cost, technical concerns, fostering creativity and efficiency		
	TD3	The integrated GBTS process brings less potential loss risk to project participants.		

RESULTS

The sample size was 384 construction industry's specialists working in Sri Lanka. Out of 367 questionnaires which were distributed, 290 were duly filled and returned. Therefore, the response rate was 75.5%. According to Nulty, (2011) a response rate of 75 per cent is adequate for analysis, for making conclusions and making inferences about a population. The researcher elaborates on the five parts of questionnaire for the respondents in this section including their gender, age, education level, working province and the current position. Majority employees who have master's qualification and it gets the 84.8% and high school studies got the least 2.4%. Construction companies in Sri Lanka majority of responders are charted engineers and it gets 54.8% of the sample. Project managers got 34.5% and senior administrative officers and chartered quantity surveyors responded for that it is accordingly 4.5% and 3.8%. And the least responses received from senior architects is 2.4%.

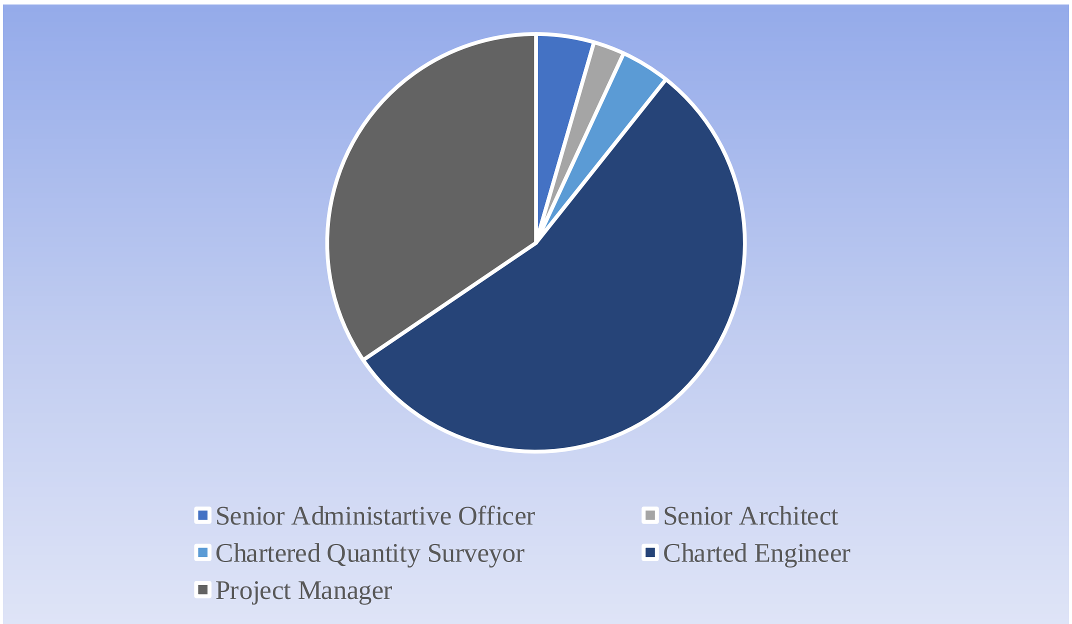


Figure 2

The highest responses 53.8% falls under southern province and for western province it gets 33.1% of the sample. And least responses received from north western province it gets 1%.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume IX Issue IIIS January 2025 | Special Issue on Education

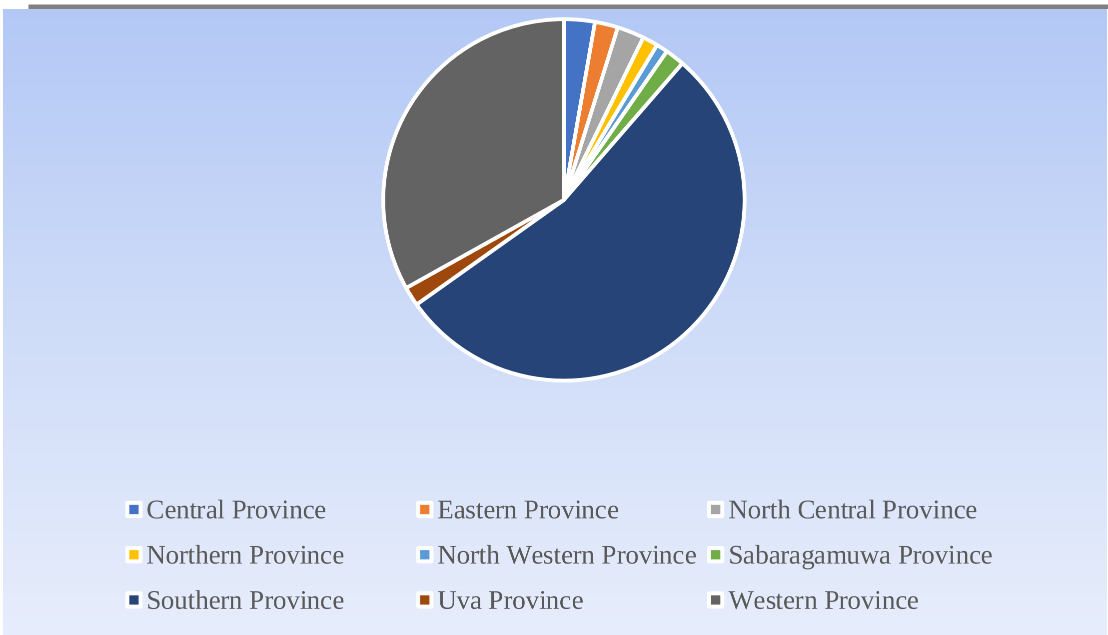


Figure 3

Table 2

Variable	**Items**	**Cronbach's Alpha>0.7**	**KMO and Bartlett's Value > 0.7**	**P -Value < 0.05**	**Consistency/ Adequacy**
Behavior Intention	3	0.963	0.762	0.000	Reliable
Management Support	3	0.948	0.761	0.000	Reliable
GBTs Capability	3	0.893	0.598	0.000	Reliable
Motivation	3	0.944	0.745	0.000	Reliable
Knowledge Structure	3	0.952	0.746	0.000	Reliable
Technical Defects	3	0.894	0.647	0.000	Reliable
Adoption of GBTs	3	0.859	0.620	0.000	Reliable

Source: Survey Data, (2024)

According to Sekaran 2003, the alpha value of $0.8 \leq \alpha < 0.9$ and $\alpha \geq 0.9$ suggests good internal consistency. The items on the test are measuring extraversion in a reliable way. The test can be considered reliable for most research purposes. As Kaiser-Meyer-Olkin, 1974 test statistic is identified, KMO > 0.50 Indicates that the values in this range suggest that the correlations among the variables are adequate for extracting meaningful factors. Bartlett's Test of Sphericity is identified as significant since p value identified as 0.000 which is lower than 0.05 (Bartlett, 1951).

Table 3

Correlations									
		Adoption of GBTs	Behavior Intention	Management Support	GBTs Capability	Motivation	Knowledge Structure	Technical Defects
	Pearson	1						
	Sig. (2-tailed)							
Behavior Intention	Pearson	.929**	1					
	Sig. (2-tailed)	.000						
Management Support	Pearson	.901**	.951**	1				
	Sig. (2-tailed)	.000	.000					
GBTs Capability	Pearson	.915**	.929**	.957**	1			
	Sig. (2-tailed)	.000	.000	.000				

Motivation	Pearson	.917**	.938**	.966**	.931**	1		
	Sig. (2-tailed)	.000	.000	.000	.000			
Knowledge Structure	Pearson	.899**	.947**	.962**	.942**	.960**	1	
	Sig. (2-tailed)	.000	.000	.000	.000	.000		
Technical Defects	Pearson	.923**	.947*	.949**	.909**	.948**	.943**	
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	1

Bivariate correlations were run among variables measuring the relationship between independent variables and dependent variables. As shown in Table 3, all correlations between Behavior Intention, Management Support, GBTs Capability, Motivation, Knowledge Structure, Technical Defects with Adoption of GBTs are positive, strong and significant at the p<0.05 level

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.443	0.044		10.059	0.000
	Behavior Intention	0.385	0.056	0.453	6.825	0.000
	Management Support	0.599	0.088	0.637	6.838	0.000
	GBTs Capability	0.562	0.064	0.558	8.812	0.000
	Motivation	0.414	0.071	0.450	5.798	0.000
	Knowledge Structure	0.266	0.073	0.277	3.622	0.000
	Technical Defects	0.383	0.060	0.426	6.413	0.000

Hypothesis Testing

According to the result generated in the co-efficient table, p value Behavior Intention: = 0.000 (p < 0.05), which is less than 0.05. The beta value of behavior intention and adoption of GBT is 0.385. In the Coefficients table, behavior intention shows the expected change in the adoption of GBT for a one-unit increase, along with p-values to determine significance (p < 0.05). The standardized Beta is 0.453, indicating that behavior intention has a moderate effect on the dependent variable. p value of Management Support = 0.000 (p < 0.05), which is less than 0.05. The beta value of Management Support and adoption of GBT is 0.599. The standardized Beta is 0.637, which is the highest among all the predictors, indicating that management support has the strongest impact on the outcome. p value of GBTs Capability = 0.000 (p < 0.05), which is less than 0.05. The unstandardized coefficient for GBTs Capability is 0.562, meaning that for every unit increase in the capability of GBTs the dependent variable increases by 0.562 units. The standardized Beta is 0.558, showing a relatively strong relationship between GBTs capability and the outcome. p value of Motivation = 0.000 (p < 0.05), which is less than 0.05. The unstandardized coefficient for Motivation is 0.414, meaning that a one-unit increase in motivation results in a 0.414 increase in the dependent variable. The standardized Beta of 0.450 suggests a moderate relationship between motivation and the outcome.

p value of Knowledge Structure = 0.000 (p < 0.05), which is less than 0.05. The unstandardized coefficient for Knowledge Structure is 0.266, indicating that a unit increase in knowledge structure leads to a 0.266 increase in the dependent variable. The standardized Beta is 0.277, which is lower than the other factors. its impact is weaker compared to the other variables. p value of Technical Defects = 0.000 (p < 0.05), which is less than 0.05. The unstandardized coefficient for Technical Defects is 0.383, meaning that for each unit increase in technical defects, the dependent variable increases by 0.383 units. The standardized Beta is 0.426, suggesting a moderate to strong influence of technical defects on the outcome. The p value of all the variables were identified 0.000 which is less than 0.05. here we concluded that there is a significant impact between Behavior Intention, Management Support, GBTs Capability, Motivation, Knowledge Structure, Technical Defects on adoption of Green Building Technologies.

DISCUSSION

Green building is widely recognized as a key strategy for achieving sustainable development in the construction industry, addressing environmental, economic, and social dimensions. Green building technologies (GBTs) play a crucial role in the realization of green buildings. To effectively promote and expand the adoption of GBTs, it is essential to gain a deep understanding of the key critical factors that affect their implementation. To promote the effective adoption and better application of GBTS in green building practice, researcher find it essential to have a better understanding of the behavior of construction specialists in adopting GBTS. The framework for this investigation is based on the Theory of Reasoned Action (TRA), which provides a foundation for analyzing the factors that hinder the adoption of GBTs.

According to the research result of the model, All the predictors in the model are statistically significant ($p < 0.05$), and several have strong standardized coefficients, indicating that they play a key role in explaining the adoption of green building technologies. Among the most influential variable is Management Support. In the organization management support is an important criterion for guiding and improving the ability of construction specialist to apply and adopt GBTS (Darko & Chan, 2017). The support and commitment of top management are key to the success of adoption. Without this support and commitment, it would not be possible to successfully implement GBTS (Tao & Jochen,2013). GBTS follows a top-down approach, where senior managers have greater influence and authority than lower-level employees within the company (Ball, 2002). Top management support extends from shaping corporate strategy to overseeing day-to-day operations (Chan et al., 2018). A lack of senior management support can significantly hinder the success of a GBTS project (Chan et al., 2017).

The second important factor affecting the adoption of GBTS is the GBTs Capabilities. Effective cooperation is the most important part in construction projects to make sure its successful adoption (Mohan et al.,2004). Project teams should have experience in collaboration, documentation and application of GBTS. Lack of interest and the ability to adopt GBTS among project team members may affect the success of its adoption (Hwang & Ng,2013). Professional knowledge and expertise are crucial factors in the successful adoption of GBTS. According to Wei wang et al, 2018 the trend in adoption of GBTS has created a growing and urgent demand for green technology talents and workers. In order to achieve high performance results in an organization, skilled workers are needed in each sector Darko et al., 2017. Lack of employees with necessary skills, expertise and knowledge will make it difficult for an organization to adopt GBTS Darko et al.,2017.

The lack of incentives is another barrier in adoption of GBTs. According to Olubunmi, et al., (2016), GB incentives are two folds; external incentives and internal incentives. External incentives are the extrinsic motivation factors provided by the government upon the fulfilment of stipulated conditions (Olubunmi, et al., 2016. There are two types of external incentives; financial incentives and non-financial incentives. Financial incentives are direct grants, tax incentives, rebates, and discounted development application fees (Karkanias, et al., 2010; Shapiro, 2011). A study which analysed the government-based funding inequalities as a major barrier to implementing GB practices (Zhao and Zou, 2016). The internal motivation refers to the degree of willingness of the designers to adopt GBTS. This is primarily due to the trade-offs among the technological benefits, costs and other perceived benefits of technology adoption Green et al.,2005. According to Wei wang et al., 2018, specialist is motivated by the adoption of novel technologies and the success of their peers and will take the initiative to learn new green technologies and current development in the construction industry.

The behavior intention of a construction specialist is the most important factor. “Behavior Intentions are assumed to capture the motivational factors that influence behavior; they are indications of how hard people are willing to try, of how much of an effort they are planning to exert, to perform the behavior. Generally, the stronger the intention to engage in a behavior, the more likely should be its performance” (Ajzen, 1991). The behavior intention of construction specialists plays a crucial role in the adoption of green building technologies. Research indicates that higher levels of knowledge and awareness about sustainable practices significantly enhance the likelihood of adoption (Rogers, 2003). Furthermore, specialists are more inclined to embrace green technologies when they recognize tangible benefits, such as cost savings and improved performance (Zuo & Zhao, 2014). Social influences and regulatory frameworks also shape these intentions, with compliance pressures and peer advocacy fostering a greater commitment to sustainability (Kibert, 2016). Nduka and Ogunsanmi, (2015) also highlighted that GBTs practices are impede by lack of awareness and higher cost of training, and for professional bodies to educate their members on GBT principles. The behavioral intention of construction specialists is a key factor that affects their adoption behavior of GBTS, and it affects organizational effectiveness (Skibniewski & Zavadskas, 2013).

Further, a well-developed knowledge structure is crucial for the successful adoption of Green Building Technology Systems (GBTS). A lack of professional expertise in this area can slow down the progress of green construction (Ametepey et al., 2015; Karunasena & Thalpage, 2016). To effectively implement advanced green technologies and materials, skilled GB professionals are essential. The absence of such expertise can lead to increased costs (Choi, 2009), while untrained labor in green construction can compromise quality (Karunasena & Thalpage, 2016). Therefore, a strong knowledge base and extensive experience in GBTS adoption are key to ensuring the rational and effective application of these systems (Ozorhon & Cinar, 2015). Support from the previous study, such as Mahat et al. (2019) and Murtagh, Roberts, and Hind (2016), supported that information, knowledge, and awareness influence the intention to adopt green building technology. The concept of sustainability and green building is not only physical but to be applied to the community subtly in educating people to be more open to current technology while also contributing to the reduction in the use of materials that pollute the environment.

Numerous studies have identified various obstacles to the adoption of Green Building Technology Systems (GBTS) (Darko & Chan, 2017). One significant barrier is the lack of comprehensive databases and information on GBTS, which makes it challenging for practitioners in the construction sector to access relevant data. Additionally, issues such as a shortage of GBTS suppliers and technological mismatches further complicate the adoption process (Chan et al., 2018). In China, the green building market remains undeveloped, with problems like poor applicability of GBTS and a lack of demonstration projects, preventing developers and designers from obtaining sufficient information about these systems. Darko et al. (2018) emphasized that improving access to better information is critical for facilitating GBTS adoption. Another major challenge is the high cost of GBTS, which is a key deterrent for its widespread adoption in both developing and developed countries. The cost of GBTS is significantly higher than that of traditional construction technologies (Gou et al., 2013), with some practitioners estimating that it could increase project costs by 10–20% (Chan et al., 2018). Moreover, the adoption of GBTS involves numerous risks and uncertainties, such as the need for adjustments in product integration, secondary development of process designs, and increased task complexity. Based on the value of the research result, all the alternative hypothesizes of the study were accepted. Hence the data supported the hypothesis that there is a significant impact between critical factors on GBT's Adoption. The results align closely with findings from previous studies and the existing body of literature.

CONCLUSION

As a developing country, Sri Lanka faces a variety of challenges, including deep poverty, rapid urbanization, weak governance, corruption, environmental degradation, and social inequity. Addressing these issues requires a strong focus on sustainable development, particularly through the adoption of new technologies that can improve the country's resilience and quality of life. One such technology gaining traction worldwide is Green Building Technology (GBT), which promotes sustainability in construction. Green Building concept is an upcoming trend in Sri Lankan construction industry as well. There are several numbers of large iconic green buildings erected in Sri Lanka. The best examples are Mass fabric plant in Thulhiriya and Kandalama Hotel and many more.

As according to the history of Sri Lankan green buildings, there are two green rating systems which was initiated and practicing in the construction field. Blue Green Sri Lanka Green Building Guidelines for Sri Lanka implemented by Urban Development Authority in 2017 and Green SL Rating System for Built Environment implemented by Green Building Council of Sri Lanka. Both rating systems cover a wide range of topics, including management, sustainable site development, water efficiency, material resources and waste management, indoor air quality, innovation in design, and social and cultural awareness. In 2010, a new Construction rating system called GREENSL® rating system which is very much similar to the LEED has been introduced by the green building council to issue the green certification.

However, there are still many problems and obstacles in the adoption and promotion of GBTS. One of the key obstacles is the limited acceptance of GBTs among construction specialists, who play a key role in the implementation of these technologies. To promote the effective adoption and better application of GBTS in green building practice, researcher find it essential to have a better understanding of the behavior of construction specialists in adopting GBTS. The findings of the study disclosed that mainly, the stakeholders' perception towards the implementation of GBTs highlighted lack of incentives for sustainable construction, higher initial cost, lack of credible research on the benefits of green building, lack of awareness and knowledge, resistance to change from conventional to green practices by company's employee, are the major obstacles that have been found through the survey in the order of the priority. Through the research the 'behavioral intention of construction industry' for this new concept was revealed as the main obstacle on implementing the Green Building Concept. A well-structured implementation process for the Green Building concept, following a clear and effective procedure, will significantly enhance the adoption of green building practices within the local construction industry and lead to a substantial improvement in overall performance of the country.

This research aims to explore the adoption of GBTs from the perspective of construction specialists in Sri Lanka, offering awareness about the factors that affect their willingness to adopt new technologies. Due to time limitation, this paper simply focused the adoption of GBTS by construction specialist in the field of construction only. Future research should continue the adoption of GBTS and other areas by Architects, designers, real estate developers, government, policy makers, corporate organization, educational institutions, environmental organizations and investors, etc. This study provides valuable insights into the challenges and opportunities associated with the adoption of Green Building Technologies, which is crucial for sustainability development in Sri Lanka's construction sector and beyond.

REFERENCE

1. Ajzen, I. (1991). The Theory of Planned Behavior. Organizational Behavior and Human Decision Processes, 50(2), 179–211.

2. Ajzen, I., & Fishbein, M. (1980). Understanding attitudes and predicting social behavior. Prentice-Hall.
3. Azizi, N. S. M., Wilkinson, S., & Fassman, E. (2015). Do occupants in green buildings
4. Ball, J. Can ISO 14000 and eco-labelling turn the construction industry green? Build. Environ. 2002, 37, 421–428.
5. Berardi, U. (2013). Stakeholders' influence on the adoption of energy-saving technologies in Italian homes. Energy policy, 60, 520-530.
6. Bougie, R., & Sekaran, U. (2019). Research methods for business: A skill building approach. John Wiley & Sons.
7. Case Study: Hong Kong BEAM: Green Building Label. 2008. Available online: http://oldwww.wbcsd.org/
8. Chan, A.P.C.; Darko, A.; Ameyaw, E.E. Strategies for Promoting Green Building Technologies Adoption in the Construction Industry-An International Study. Sustainability 2017, 9, 969.
9. Chan, A.P.C.; Darko, A.; Olanipekun, A.O.; Ameyaw, E.E. Critical barriers to green building technologies adoption in developing countries: The case of Ghana. J. Clean. Prod. 2018, 172, 1067–1079.
10. Construction, M. H. (2013). World green building trends: Business benefits driving new and retrofit market opportunities in over 60 countries. Bedford Massachusetts: Smart Market Report.
11. Darko, A.; Chan, A.P.C. Review of Barriers to Green Building Adoption. Sustain. Dev. 2017, 25, 167–179.
12. Darko, A.; Chan, A.P.C. Strategies to promote green building technologies adoption in developing countries: The case of Ghana. Build. Environ. 2018, 130, 74–84.
13. Darko, A.; Chan, A.P.C.; Ameyaw, E.E.; He, B.J.; Olanipekun, A.O. Examining issues influencing green building technologies adoption: The United States green building experts' perspectives. Energy Build. 2017, 144, 320–332.
14. Darko, A.; Zhang, C.Z.; Chan, A.P.C. Drivers for green building: A review of empirical studies. Habitat Int. 2017, 60, 34–49. DocRoot/EDlu2NXcBSMEJrKtBKHJ/hk-beam.pdf (accessed on 14 April 2015).

15. Du Plessis, C. (2007). A strategic framework for sustainable construction in developing countries. Construction management and economics, 25(1), 67-76.
16. Gan, X., Zuo, J., Ye, K., Skitmore, M., & Xiong, B. (2015). Why sustainable construction? Why not? An owner's perspective. Habitat international, 47, 61-68.Ghoddousi et al., 2015
17. Geng, X.; Wen, Y.; Zhou, C.; Xiao, C. Establishment of the sustainable ecosystem for the regional shipping industry based on system dynamics sustainability. Sustainability 2017,9, 742.
18. Gou, Z.; Lau, S.S.; Prasad, D. Market readiness and policy implications for green buildings: Case study from Hong Kong. J. Green Build. 2013, 8, 162–173
19. Green, S.D.; Fernie, S.; Weller, S. Making sense of supply chain management: A comparative study of aerospace and construction. Constr. Manag. Econ. 2005, 23, 579–593
20. H. Karunathilake et al.Opportunities and challenges in energy demand reduction for Canadian residential sector: a review Renew. Sustain. Energy Rev.(2017) https://archive.epa.gov/greenbuilding/web/html/about.html (accessed on 28 March 2017).
21. Hwang, B. G., & Ng, W. J. (2013). Project management knowledge and skills for green construction: Overcoming challenges. International journal of project management, 31(2), 272-284.
22. Hwang, B.G.; Zhu, L.; Ming, J.T.T. Factors Affecting Productivity in Green Building Construction Projects: The Case of Singapore. J. Manag. Eng. 2017, 33, 04016052.
23. Hwang, B.G.; Zhu, L.; Tan, J.S.H. Green business park project management: Barriers and solutions for Ignatius, J.; Rahman, A.; Yazdani, M.; Saparauskas, J.; Haron, S.H. An Integrated Fuzzy Anp-Qfd Approach for Green Building Assessment. J. Civ. Eng. Manag. 2016, 22, 551–563.
24. IPCC (Intergovernmental Panel on Climate Change). Climate Change 2014: Synthesis Report; IPCC: Geneva, Switzerland, 2014.
25. Kaiser, H. F. (1974). An index of factorial simplicity. Psychometrika, 39(1), 31–36.
26. Klugman, J. (2011). Human Development Report 2011. Sustainability and Equity: A better future for all. Sustainability and Equity: A Better Future for All (November 2, 2011). UNDP-HDRO Human Development Reports.
27. Koebel, C. T., McCoy, A. P., Sanderford, A. R., Franck, C. T., & Keefe, M. J. (2015). Diffusion of green building technologies in new housing construction. Energy and Buildings, 97, 175-185.
28. Mohan, K.; Peter, E.D.L.; Mohammed, D. Integrating procurement and operational innovations for construction industry development. Eng. Constr. Archit. Manag. 2004, 11, 323–334.
29. Mulligan, T. D., Mollaoğlu-Korkmaz, S., Cotner, R., & Goldsberry, A. D. (2014). Public policy and impacts on adoption of sustainable built environments: Learning from the constuction industry playmakers. Journal of Green Building, 9(2), 182-202.
30. Nduka, D. O., & Ogunsanmi, O. E. (2015). Stakeholders perception of factors determining the adoptability of green building practices in construction projects in Nigeria. Journal of Environment and Earth Science, 5(2), 188-196.
31. Nguyen, H. T., Skitmore, M., Gray, M., Zhang, X., & Olanipekun, A. O. (2017). Will green building development take off? An exploratory study of barriers to green building in Vietnam. Resources, Conservation and Recycling, 127, 8-20.
32. Nulty, D. D. (2011). Peer and self-assessment in the first year of university. Assessment & evaluation in higher education, 36(5), 493-507.
33. Ozorhon, B.; Cinar, E. Critical Success Factors of Enterprise Resource Planning Implementation in Construction: Case of Turkey. J. Manag. Eng. 2015, 31, 04015014 Pdfs/sbci_2pager_eversion_Feb2011.pdf (accessed on 27 March 2017).
34. Practice better energy saving behaviour in computer usage than occupants in conventional buildings?. Journal of Green Building, 10(4), 178-193.Djokoto et al., 2014
35. Rathnasiri, P., & Jayasena, S. (2022). Green building information modelling technology adoption for existing buildings in Sri Lanka. Facilities management perspective. Intelligent Buildings International, 14(1), 23-44.
36. Rogers, E. M. (2003). Diffusion of innovations, 5th edn Tampa. FL: Free Press.
37. Roufechaei, K. M., Bakar, A. H. A., & Tabassi, A. A. (2014). Energy-efficient design for sustainable housing development. Journal of cleaner production, 65, 380-388.Ahmad et al., 2016

38. Sandanayake, M.; Zhang, G.M.; Setunge, S.; Li, C.Q.; Fang, J. Models and method for estimation and comparison of direct emissions in building construction in Australia and a case study. Energy Build. 2016, 126, 128–138.
39. Sev, A. How can the construction industry contribute to sustainable development? A conceptual framework. Sustain. Dev. 2009,17, 161–173.
40. Shan, M., & Hwang, B. G. (2018). Green building rating systems: Global reviews of practices and research efforts. Sustainable cities and society, 39, 172-180.
41. Shen, L.Y.; Yan, H.; Fan, H.Q.; Wu, Y.; Zhang, Y. An integrated system of text mining technique and case-based reasoning (TM-CBR) for supporting green building design. Build. Environ. 2017, 124, 388–401.
42. Skibniewski, M.J.; Zavadskas, E.K. Technology Development in Construction: A Continuum from Distant Past into the Future. J. Civ. Eng. Manag. 2013, 19, 136–147.
43. Son, H.; Kim, C.; Chong, W.K.; Chou, J.S. Implementing sustainable development in the construction industry: Constructors' perspectives in the US and Korea. Sustain. Dev. 2011,19, 337–347 sustainable development. J. Clean. Prod. 2017,153, 209–219.
44. Tabassi, A. A., Roufechaei, K. M., Ramli, M., Bakar, A. H. A., Ismail, R., & Pakir, A. H. K. (2016). Leadership competences of sustainable construction project managers. Journal of cleaner production, 124, 339-349.Geelani et al., 2012
45. Tao, C.; Jochen, T. Real-time resource location data collection and visualization technology for construction safety and activity monitoring applications. Autom. Constr. 2013, 34, 3–15.
46. Thalpage, R., & Karunasena, G. (2016). Approaches to foster green building constructions in Sri Lanka.
47. UNEP. Sustainable Buildings and Climate Initiatives. 2011. Available online: http://www.docin.com/p-1456121389.html (accessed on 27 March 2017).
48. United States Environmental Protection Agency. Definition of Green Building. 2016. Available online: USEPA. Definition of Green Building. 2016. Available online: https://archive.epa.gov/greenbuilding/web/html/about.html (accessed on 28 March 2017).
49. Vatalis, K. I., Manoliadis, O., Charalampides, G., Platias, S., & Savvidis, S. J. P. E. (2013). Sustainability components affecting decisions for green building projects. Procedia Economics and Finance, 5, 747-756.
50. Wang, H.; Zhang, X. An analysis on the resource consumption in the Chinese construction industry. Constr. Econ. 2008, S1, 7–11.
51. Wang, W., Zhang, S., Su, Y., & Deng, X. (2018). Key factors to green building technologies adoption in developing countries: the perspective of Chinese designers. Sustainability, 10(11), 4135.
52. World Business Council for Sustainable Development. Collaborative Action for Energy Regional Network World Economic Situation and Prospects, 2014
53. Yudelson, J. Green Building A to Z: Understanding the Language of Green Building; New Society Publishers: Gabriola Island, BC, Canada, 2007.
54. Zhang, R., Tang, Y., Zhang, Y., & Wang, Z. (2023). Collaborative relationship discovery in green building technology innovation: Evidence from patents in China's construction industry. Journal of Cleaner Production, 391, 136041.
55. Zhao, X.; Hwang, B.G.; Hong, N.L. Identifying critical leadership styles of project managers for green building projects. Int. J. Proj. Manag. 2016, 16, 150–160.
56. Zuo, J., & Zhao, Z. Y. (2014). Green building research–current status and future agenda: A review. Renewable and sustainable energy reviews, 30, 271-281.